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WATER TREATMENT PLANT DESIGN AT M.I.D.C, AVDHAN, DULE

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ABSTRACT

Now a day's water scarcity is the burning issue. As it is quite obvious that there is day to day increase in population, the demand for water also increases to satisfy the needs of the community there comes a necessity to redesign the existing treatment plants, or design the new treatment plants. Redesign or design includes hydraulic design and process of treatment of water in the plant. I are designing the water treatment plant for MIDC, Avadhan, Dhule . The source of raw water is Akkalpada Dam. The properties of water changes based on its surface source. Thus there is a lot of importance to design treatment plant to MIDC, Avadhan, Dhule. This Project includes the detail of the treatment units present in the MIDC, which are nine (9) in total, and foreseeing the increasing demand of water. In the previous semester the main objective was to study these existing Treatment Plant. all these treatment plants have been designed and their capacity has been increased. It involves all the design calculations for the new treatment plant and also the design criteria on which these have been designed. The project involves the new proposed site called as Raver which is located in surrounding area of Avadhan MIDC Dhule.. And with the help of this area the expansion is possible and can be easily done. Overall the main purpose of this project is to help and propose a new design to the MIDC so that the future needs of the increasing industries can be met, and all the industries can effectively use this water.

KEYWORDS: Design, Water Treatment Units ,Water , Flocculation Tank, Rapid Sand Filter.

I. INTRODUCTION

MIDC (Maharashtra Industrial Development Corporation**)** is a major project of government of MIDC of Maharashtra state, India, and is a leading corporation of Maharashtra. It provide business with infrastructure such as lands, road, water supply drainage facility and street light. MIDC Dhule has an industrial area of 400.35heactor of land .about 278.0 hector has come into possession of MIDC. It provide all the basic infrastructure such as roads, street lights, water supply, pipelines in this area. The existing water treatment plant of MIDC fulfills its need of water from Moti dam. The plant was constructed in the year 1984, when the member of industries was 150. The capacity of the plant in present today is 4.5 MLD. As the number of industries is increasing day by day it has become a must to increase its capacity for fulfilling the need in near future. MIDC, Dhule has decided to take the surrounding area known as "Raver" into possession to fulfill the future needs. As per the demand the most important thing here is to design as per the current 550 number of industries. So, here The project deals with concept of redesigning of the treatment units step by step which the most essential part upto 17 MLD, also the cost of the new treatment plant is to be calculated.

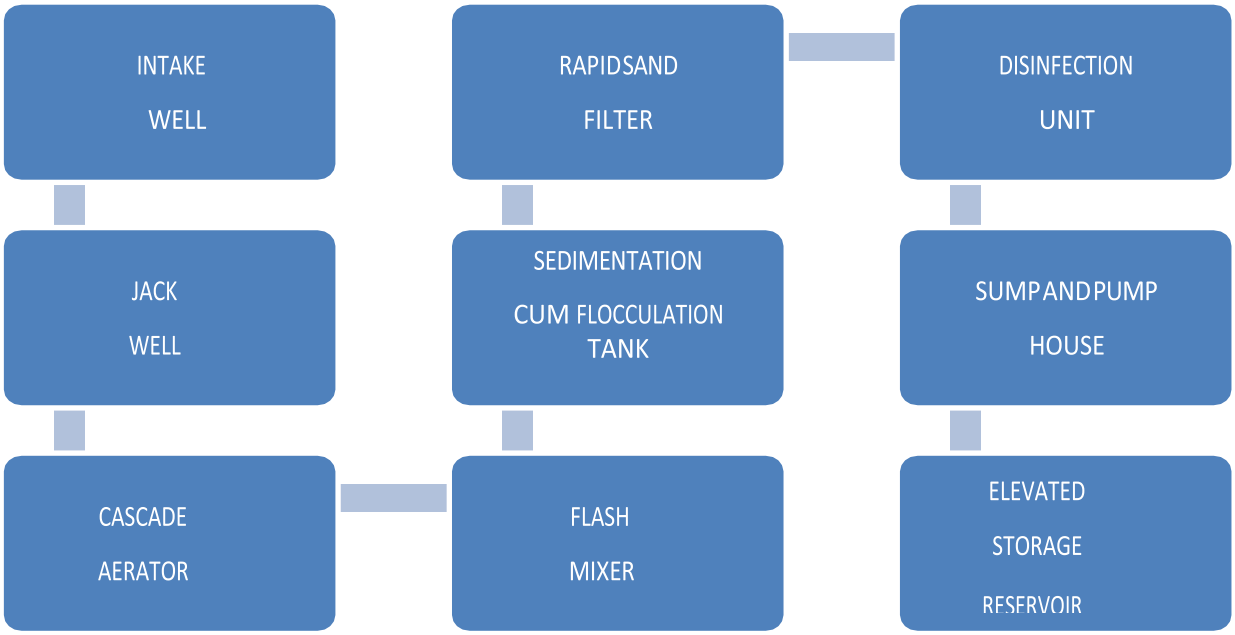
II. METHODOLOGY

a) Study Of Existing Water Treatment Plant At Midc, Avdhan, Dhule:

The Study Involves Detailed Description Of All The Following Units, As Referred By M.I.D.C

- Intake Well
- Jack Well

- Cascade Aerator
- Flash Mixer
- Sedimentation cum Flocculation Tank
- Rapid Sand Filter
- Disinfection Unit
- Sump and Pump House
- Elevated Storage Reservoir



b) DESIGN CONSIDERATIONS

- **DESIGN CRITERIA FOR INTAKE WELL:-**

- Areas of inlet openings are worked out by considering the velocity of flow between **0.1 to0.25m/s.**
- Inlet opening should be **1 to 1.5m** below water level.
- Diameter of Intake well is about **3 to 5 m.**
- Bottom of Intake well should be at least **3m** below minimum water level.
- Raw water gravity main is designed by using Hazen William formula, with velocity of water through the main ranging between **0.9 to 1.5 m/s.**

- **DESIGN CRITERIA FOR CASCADE AERATOR:-**

- A simplest cascade consists of a series of **3 to 4 steps.**
- Water is allowed to fall through a height of **1 to 3 meters.**
- Diameter of central shaft is considered to be **1.2 m.**

- **DESIGN CRITERIA FOR FLASH MIXER:-**

- Detention Time = 1 to 3 minutes.
- Square or circular basins are used for mixing depth = 1 to 11.5 m
- Velocity gradient = 700 to 1000 s^{-1}.

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- **DESIGN CRITERIA FOR SEDIMENTATION TANK:-**

- Overflow rate =**15-30m³ /d/m.**
- Minimum side water depth =**2.5m.**
- Detention period for coagulated water **2-4hrs.**
- Weir loading = **300m³/d/m.**
- Side slopes for non mechanical cleaning =**10%** from sides towards longitudinal central line.
- Longitudinal slope = **1%** in case of rectangular tank.
- Ratio of length and width = **3:1 to 5:1.**
- Settling velocity = To ensure removal of minimum size of particle of **0.02mm.**
- Detention time to flocculation chamber = **20-30min.**
- Skimming weir = To check the froth on the surface of outlet to reduce load on the filter.
- Horizontal flow velocity = **0.15-0.9 m/s.**

- **DESIGN CRITERIA FOR CLARIFLOCCULATOR:-**

- Depth of basin = **3m to 4.5m.**
- Detention time = **20 to 60 min.**
- For rectangular type = length / width = **2 to 3.**
- Total paddle area = **15 to 20 %** of vertical cross section basin.
- Distance between paddle edge and bottom or side of basin = **15 to 30 cm.**
- The peripheral velocity of paddle = **0.2 to 0.6 m/s.**
- Horizontal velocity of flow = **1.5 to 2 cm/s.**
- Velocity difference between paddle of water = **75%** of paddle velocity.
- G = velocity gradient = **10 to 75 /sec.**
- Power consumption = **18 to 36 KW/ MLD.**
- Coefficient of drag = **1.8** for flat paddle with flat plate.
- Product G×t should be between **10^4 to 10^5**

- **DESIGN CRITERIA FOR RAPID GRAVITY FILTER:-**

- Rate of filtration = **3000 to 6000 lit/hr/m².**
- Number of filter units N=√(Q) **14.69** (Q in m³/hr).
- Filter bed size = L:B ratio = **1.25 to 1.33.**
- Depth of filter sand media = **60 to 90 cm.**
- Depth of base material (gravel) = **30 to 60 cm (well-graded).**
- Sand specification = maximum size = **1mm.**

Minimum size = **0.45mm.**

Effective size = **0.35 to 0.6 mm.**

Depth of water area sand = **1 to 2 m.**

Amount of wash water = **2 to 4 % water filtered.**

- **DESIGN CRITERIA FOR UNDER DRAIN SYSTEM:-**

- Ratio of length of lateral to its diameter = **60.**
- Diameter of perforations in laterals = **5 to 12 mm.**
- Spacing of perforations along the lateral = **8 cm** for **5mm** holes. **20 cm** for **12mm** holes.
- Ratio of total area of perforation to the total cross sectional area of laterals = **0.25 for 5 mm.**
- Spacing of laterals = **30 cm.**
- The ratio of total area of perforation in the under drainage system to the entire filter area may be between **0.002 to 0.003.**

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- Cross sectional area of manifold = **1.5 to 2** times the total cross-sectional area of laterals.

- **DESIGN CRITERIA FOR WASH WATER TROUGH:-**

- Horizontal travel of dirty water over the surface of filter shall not be more than **0.5 to 1.0 m** before reaching trough.
- Bottom of trough should clear the top of expanded sand by **50 mm** or more.
- Upper edge of trough should be placed as far as above the surface of the undistributed sand surface as the wash water rises in **1min.**

C) COST CALCULATIONS

Sr. No	Storage Capacity	Area In M2	Block Rates In Rs.
01	Intake Well	2.4*1.05=2.52m2	
02	Aerator	22.38m2	6900*22.38=154422rs
03	Flash Mixer	4.85*4.85	23.5225*13070=307439.75rs
04	Sedimentation Tank	721.066	721.066*14251=10275911rs
05	Filter House	29.8	10780*29.8=321244
06	Elevated Storage Reservoir	8.5mld (2 Tanks)	8.5*25lakhs=21250000rs
			Total = Rs 32,309,016.75

III. RESULTS AND DISCUSSIONS

Sr No.	Treatment Units	Existing WTP(4.5 Mld)	Proposed WTP(17 Mld)
1	**Intake Well**	-	3.5 M Φ
	Coarse Screen	-	Length - 2.4 M Height – 1.05 M
	Bell Mouth Entry	-	1.0 M Φ
	Intake Conduit	-	0.45 M Φ
2	**Raw Water Rising Main**		
	Diameter	350 Mm	600 Mm
	Distance	1.23 Km	40 Km
3	**Cascade Aerator**		
	Area	-	22.38 M^2
	Diameter	-	5.34 M
4	**Flash Mixer**	1.0 M X 1.0 M X 2.75 M	4.85 M X 4.85 M X 1.5 M
5	**Sedimentation Tank**		
	Area	213.82 m^2	721.066 m^2
	Detention Period	180 min	180 min
6	**Clariflocculator**		

	Inner Diameter	6.30 m	12.25 m
	Outer Diameter	16.5 m	30.3 m
7	**Filter House**		
	Number of Units	4	6
	Area	-	29.8 m^2 (per unit)
8	**Pure Water Rising Main**		
	Diameter	350 mm	600 mm
	Distance	0.117 km	0.150 km
9	**Elevated Storage Reservoir**	2 MLD (2 Tanks Each 1 MLD)	8.5 MLD (1 Tank)

IV. CONCLUSION

- From the study done, it clearly suggests the role of reclaimed water in future .The growth of the industries since 1984 till upcoming future has huge water needs.
- The above study demonstrates the design for the 17MLD water treatment plant considering the key factors such as source, area demand, industrial growth.
- A typical step-by-step design for WTP units is presented.
- Procedures, detailed calculations, and drawings are illustrated.
- On comparison with the existing treatment plant, the cost of this project is easily achievable. The outcome of the project is that the new proposed water treatment plant is economical.

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